DOCUMENT RESUME

ED 105 430 CS 001 759

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TITLE Hierarchical Subskills in the Reading Acquisition Process.
PUB DATE May 75
NOTE 33p.; Paper presented at the Annual Meeting of the International Reading Association (20th, New York City, May 13-16, 1975)

EDRS PRICE MF-$0.76 HC-$1.95 PLUS POSTAGE
DESCRIPTORS *Beginning Reading; Elementary Education; Reading; *Reading Development; Reading Improvement; *Reading Instruction; *Reading Processes; Reading Research; Reading Skills; Teaching Procedures

ABSTRACT

Numerous controversies pertain to the psychology and pedagogy of reading. Among the more important controversies are questions pertaining to the existence of a hierarchy of reading subskills and the advisability of using a subskill approach. Several influential writers have warned that when the process of learning to read is fractionated into subskills, the essential goal of reading, extraction of meaning, is lost. This argument has persuaded a sizable segment of the teaching community to begin reading instruction with what is essentially a holistic approach. The purpose of this article is not to take issue with those who advocate a holistic method, but to extract the best from each approach to the reading acquisition process in order to improve teaching effectiveness. In pursuit of this goal, the controversy between holistic and part methods of instruction is cast in historical perspective, and a comparison between speech and reading acquisition is made. Arguments are presented to the effect that learning hierarchies do exist in reading; that although we do not presently know the precise nature of these hierarchies, methods are available for their determination; and that the most efficient way to teach a complex skill such as reading is to simplify the task by breaking it into subskills. (Author)

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Hierarchical Subskills in the Reading Acquisition Process

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Abstract

Numerous controversies are to be found pertaining to the psychology and pedagogy of reading. Among the more important controversies are questions pertaining to the existence of a hierarchy of reading subskills and the advisability of using a subskill approach. Several influential writers have warned that when the learning-to-read process is fractionated into subskills, the essential goal of reading, extraction of meaning, is lost. This argument has persuaded a sizeable segment of the teaching community to begin reading instruction with what is essentially a holistic approach. The purpose of this article is not to take issue with those who advocate a holistic method, but to extract the best from each approach to the reading acquisition process in order to improve teaching effectiveness. In pursuit of this goal, the controversy between holistic and part methods of instruction will be cast in historical perspecitve and a comparison between speech and reading acquisition will be made. Arguments will be presented to the effect that learning hierarchies do exist in reading; that although we do not presently know the precise nature of these hierarchies, methods are available for their determination; and that the most efficient way to teach a complex skill such as reading is to simplify the task by breaking it into subskills.

Hierarchical Subskills in the

Reading Acquisition Process

Not to know the past is to repeat history many times over. "Do not fear to repeat what has been said. Men need the truth dinned into their ears many times and from all sides. The first rumor makes them prick up their ears, the second registers, and the third enters."

Rene Laennec

Professor of Medicine

College de France

Historical Perspective

All of us are aware of the extent to which men have fractionated themselves. We have compartmentalized ourselves into nations, nations into political factions. The World Almanac lists eighty-one major religious bodies in the United States. Reading has not escaped this trend, and it, too, has its denominations and variegated approaches to a problem like reading instruction.

The current debate going on in educational circles as to whether reading should be introduced more or less as an holistic process with an emphasis on meaning and comprehension, or whether it should be taught by means of a subskill approach, is not an entirely new problem. In fact, the problem goes back some 100 years and was fought on two continents. The alphabetic method of teaching reading, which was used almost universally in Greece and Rome and in European countries generally until well into the nineteenth century, was the most common method used in America to teach reading until about 1870.

In the alphabetic method of reading instruction as practiced in Europe and on this continent, the child learned to name letters before learning to read words. After mastering the names of letters, nonsense syllables such as ab, ib, and ob were introduced. The student first spelled each letter and then pronounced the syllable. He progressed to three-letter nonsense syllables, short words, and finally sentences; naming the letters generally preceded pronouncing the syllables or words.

In 1840 Dumstead commented that the practice of drilling the child month after month on letter names was irksome to the student and teacher. The chief criticism of the alphabet method was that spelling the word before pronouncing it interfered with comprehension. As an alternative the whole word method was suggested. During the 1840's, in our country, the controversy in reading was not over phonic versus whole-word methods but over the alphabet method versus the whole-word method. By 1870 this conflict appeared to be settled in favor of the whole-word method. This method remained dominant until Rudolf Flesch published his widely read book, "Why Johnny Can't Read". (1955) In his book Flesch argued that children who were taught by the whole-word method had difficulty because of their failure to acquire word analysis skills. Flesch's criticism led to a growing emphasis on phonics as part of the initial reading method.

This brief historical sketch of reading methods used on this continent indicates the slow pendulum swing between whole and part approaches to instruction in reading. This state of flux was found in Europe just as it was on our own continent. In trying to bring the philosophical principle of "naturalness" to the reading act, Friedrich Gedike (1754-1803), one of the most influential Prussian educators of his day, was of the opinion that a book was the logical whole with which to begin instruction. He thought

that the synthetic method, that is, going from parts to the whole, was reserved for God. Man had to be content with going from the whole to its parts. Other reading methods were developed in Europe based on the principle of wholeness and naturalness where either the sentence or the word was used as the whole unit. Instruction then proceeded from the larger to the smaller units (Mathews, 1966).

From a historical stance, the controversy which has been presented is not so much a "whole" or "part" dichotomy, but a question of "when", that is, when to intoruduce a particular size unit. Part methods started with relatively small units (letters or words) and advanced to larger units (words, sentences or long passages) while the whole methods began with larger units and advanced to smaller units. The real controversy, then, appeared to be over the size of the unit with which to begin instruction, in essence a sequencing problem. As we shall see shortly this is similar to the controversy with regard to teaching the alphabet we are encountering today. As Venezky (Note 1)pointed out, "almost all methods for teaching reading include letter-sound learning somewhere in the teaching sequence, although the amount and exact placement of this training account for the central disagreement between methods."

The current debate on holistic versus a subskill approach is not a simple either/or dichotomy but one of focus, emphasis, and sequence. The problem, then, between those who advocate starting reading instruction with large meaningful units and those who advocate a subskill approach, may be overdrawn in the sense that regardless which size unit one uses for beginning reading, one must also include for instructional purposes units at the other end of the scale. This view was expressed in a recent article (Singer, Samuels, Spiroff, 1974) which stated "While this study has demonstrated that for the purpose of teaching children to identify a word it is best to present

that word in isolation...we also recognize the need for the child to get ample practice reading meaningful and interesting material in context so that he will develop strategies for using semantic and syntactic constraints in passages as aids in word recognition." (p. 566)

Another aspect of the problem we are encountering today relates to who determines which subskills should be taught and when they should be introduced. One school of thought suggests that when the student encounters a problem, the teacher should analyze the nature of the difficulty and remedy it. This approach places the teacher in the role of a "trouble shooter". Thus, the particular subskills which are taught are determined by the student, that is, by an analysis of the student's weaknesses, and the skills are introduced after the problem is uncovered. The other school of thought suggests certain subskills must be mastered in the reading acquisition process, and these skills can be taught routinely before the student shows signs of having a problem. Thus, with this approach, it is the teacher or curriculum expert who determines a priori which skills are to be taught and when. However, it would be fair to say that there are certain similarities between these two approaches and in the last section of this paper, these will be discussed.

Critics of Subskill Approaches

To bring this discussion up to date, the current debate in reading is centered about the question of what is the most efficient way to get children to read well. According to one authority, the best way to get children to read well in school is to stop trying to teach them how. At the 40th Annual Claremont Reading Conference Dr. Malcolm Douglas, Professor of Education at the Claremont Graduate School, expressed the viewpoint that the ability to read is not enhanced by teaching about reading. Douglas contends that devoting more time to the teaching about mechanics of letters and words may be

accomplishing just the opposite of our intent. According to Douglas, reading is something that must be learned indirectly as a personal, private sort of experience. The most effective way to get children to read is to surround them with a variety of reading materials and to stimulate their thinking about ideas. Then practice will provide good readers in nearly all cases.

Children, Douglas pointed out, learn to speak and listen without formal instruction; reading is a natural outgrowth of listening and talking, he said, and it is a mystery why educators think this progressive line of development should stop with oral language and then require formal instruction with written words. He contends that learning to read develops naturally in children and grows through practice and not from direct instruction from teachers.

Douglas is not alone in condemning direct instruction in reading. Perhaps the most influential critics of fractionating reading into subskills and the sequencing of these subskills are Dr. Kenneth Goodman and Dr. Frank Smith. In order to present their views on select topics such as teaching reading, subskills, and sequencing, excerpts from their published writings are listed below:

Teaching reading. We have been teaching reading as a set of skills to be learned rather than as a language process to be mastered. (Goodman, 1972, p. 506)

Universal literacy will be achieved only when we have understood enough about the reading process and its acquisition to stop interfering with learners in the name of helping them. (Goodman, 1972, p. 505)

The teacher is not so much a source of wisdom in sound reading instruction as a guide and aid, monitoring the learner's progress, offering help when a hang-up is detected, stimulating interest in reading, helping him

find relevant, worthwhile materials to read, and offering continuous encouragement. (Goodman, monograph, p. 4)

Children learn to read only by reading. Therefore the only way to facilitate their learning to read is to make reading easy for them. This means continuously making critical and insightful decisions--not forcing a child to read for words when he is, or should be, reading for meaning; not forcing him to slow down when he should speed up; not requiring caution when he should be taking chances; not worrying about speech when the topic is reading; not discouraging errors. . . (Smith, 1973, p. 195)

The skill of riding a bicycle comes with riding a bicycle. (Smith, 1973, p. 195)

Meaning must always be the immediate as well as the ultimate goal in reading. Instruction must be comprehension centered. This must be foremost in the mind of both the teacher and the learner. Every instructional activity must be organized around a search for meaning. (Goodman, Note 2, p. 24)

Subskills. Language systems are interdependent and hence language is indivisible. Fractionating language for instructional purposes into words and word parts destroys its essential nature. (Goodman, Note 2, p. 25)

Language cannot be broken into pieces without changing it to a set of abstractions: sounds, letters, words. (Goodman, 1972, p. 507)

Such research treats language as a string of sounds, letters or words; it assumes that language is like a salami that you can slice as thin as you want, each slice still retaining the characteristics of the whole. That simply is not true. Language can't be broken into pieces without qualitatively changing it. (Goodman, 1972, p. 1259)

And teaching kids to match letters to sounds is not related to the end which is comprehension. Teaching them to read nonsense is as bad because they can't tell when they're done, whether they've been successful since what they read makes no sense. (Goodman, 1972, p. 1261)

One need not be able to pronounce a word to get its meaning. Most proficient readers have many words in their reading vocabularies they do not use or have not heard used orally. (Goodman, monograph, p. 6)

We have ignored the language structure and in the name of teaching, fed children strings of letters or strings of words. (Goodman, 1972, p. 506)

Phonics isn't necessary to the reading process. In fact in a proficient reader any kind of going from print to oral language to meaning is an extremely ineffective and inefficient strategy. By inefficient is meant that it's not the best way to do it and by ineffective is meant that the reader doesn't get the results that he's after. (Goodman, 1972, p. 1261)

The question, of course, is whether in beginning stages of acquisition phonics has any function. This writer believes that excessive concern for phonics induces short circuits in reading. Instead of teaching the processing of language to get to meaning, phonics instruction teaches the processing of language to get to sounds or to get to words. (Goodman, 1972, p. 1261)

Learning hierarchies and sequencing reading skills. There is no possible sequencing of skills in reading instruction since all systems must be used interdependently in the reading process even in the first attempts at learning to read. (Goodman, Note 2, p. 25)

Frequently sequential skill instruction will interfere with comprehension since the learner's attention is diverted from meaning.

Programmed learning is another example of what happens with a narrow base. Programmed learning forces everything through the narrow bottleneck of highly systematic sequencing. It elevates sequencing to the primary consideration and then says, "Let's find something we can sequence." (Goodman, 1972, p. 1254)

The part-whole relationship is certainly distorted, perhaps destroyed in that kind of programming. Questions relating to whether, in fact,

language can be learned sequentially are ignored. (Goodman, 1972, p. 1257)

Speech and Reading Acquisition Compared

Before discussing other issues, it might be advantageous to examine Douglas' claim that learning to read should be as easily and naturally acquired as learning to speak. It should be recognized that first language acquisition with its speaking and listening components is a unique human experience and different in important ways from other kinds of learning, such as learning to read. New theories concerning the nature of language and the modes of their analysis have raised strong doubts whether traditional, associationistic, learning theoretic accounts of language are tenable. There are a number of arguments to support the belief that the child's learning a language involves innate, genetically determined mechanisms operating on information about the structure of language which a child gets from listening to the speech of adults. First, linguistic universals such as phonetic systems and syntax are common to all languages; second, historical investigations of languages reveal that although spoken languages change, at no time does one find evidence of human speech which can be described as aphonemic or ungrammatical. Third, specific language disability, characterized by delayed speech onset, poor articulation, and marked reading disability in which general intelligence remains unaffected appears to be inherited. Fourth, the developmental schedule of language acquisition follows a fixed sequence so that even if the entire schedule is retarded, the order of attainment of linguistic skills remains constant. Finally, comparisons of children learning non-Indo-European language with children learning English indicate a high degree of concordance between the milestones of speech and motor development.

While it is true that speech acquisition appears to proceed easily and

naturally, it is not at all apparent that learning to read need necessarily proceed in as easy a manner. The primary reason for this difference is that whereas speech acquisition seems to be a genetically determined behavior common to all people, reading does not follow this pattern. Speech acquisition appears to be natural to humans, much like walking, but reading is not a natural behavior indigenous to our species. Whereas all humans regardless of the culture in which they are found have developed language systems, not all societies are literate.

Interesting comparisons can be made between the acquisition of speech and learning to read. Generally, learning to speak is accomplished with little difficulty whereas learning to read requires considerably more effort. According to Staats (1963) although the process of speech acquisition is gradual, beginning at infancy and extending for a considerable period of time, theintroduction to reading is much more abrupt and less gradual. Secondly, there are strong sources of reinforcement involved with speech acquisition while in the typical classroom sources of reinforcement for reading appear to be much less forceful. Those strong reinforcers which are applied in speech acquisition seem to be applied almost immediately following appropriate speech behaviors while in the learning-to-read process, the much weaker reinforcers are often delayed or may be non-existent. According to Staats, perhaps the most important difference between speech acquisition and learning to read is that in learning to read there are intensive periods of concentration required which may easily take on aversive characteristics.

To summarize the differences between speech and reading, it is indeed accurate to say that for nearly all people first language acquisition appears to be easily mastered, but for a sizeable number of people, literacy is achieved only with difficulty, if at all. It is important to differentiate, however, between language acquired early in one's life and language acquired

later, generally following the period of puberty with the accompanying cerebral lateralization (Lenneberg, 1967). Students learning foreign languages in high school and college generally find it to be difficult. Thus, while language has the hallmarks of a species specific, genetically determined behavior which seems to be easily and naturally acquired, it is limited to languages acquired early in life and not later. Reading, on the other hand, is not a behavior common to all men and its acquisition frequently requires the expenditure of considerable time and effort.

Role of Subskills in Learning

Psychologists have known for a considerable length of time that in learning complex skills, mastery of subordinate units must precede final goal attainment. In investigating the learning curves of students taking a course in telegraphy, Bryan and Harter (1897) observed that the mastery of this complex task required the simultaneous learning of several components. They noted that there were plateaus in the learning curves during which practice did not lead to improvement. These plateaus, they thought, indicated temporary periods devoted to the organization of component skills into larger units or the learning of particularly difficult parts of the larger task. It is interesting to note that 3/4 of a century ago Bryan and Harter (1899) used a term like the "Acquisition of a Hierarchy of Habits" in the title of one of their articles, and today the role of learning hierarchies in reading is one of the issues of central importance.

While Hilgard and Marquis (1961) wrote that most learning is complex and requires the simultaneous learning of several components, questions remain about simple learning, such as associational learning. Is the formation of simple associations influenced by sub-systems?

Historically, associational learning was believed to be a simple, single-stage process, but as psychologists continued to investigate the

nature of associational learning, they discovered that stimulus-response learning was anything but a simple, single-stage process. Research in associational learning over the past twenty-five years has revealed that there are stimulus learning stages, response learning stages, and associational stages. In fact, these stages are influenced by other factors such as overt attention, perceptual learning, memory, and mediational strategies. Thus, even the so-called simple learning tasks have their complex aspects, and fractionating a simple association task into subskills can facilitate the learning process.

Even in so simple an assocaational task as learning a letter name, it appears that breaking the task into subskills facilitates learning (Samuels, 1973). In one experiment, an experimental group received visual discrimination training on noting distinctive features of letters. Following perceptual training, they learned the letter names. A control group was taught using a holistic approach; this group did not get perceptual pretraining. They were shown the letters and were told to learn their names. The experimental group which got subskill training learned in significantly fewer trials and the savings were enough to make a practical difference as well.

There are a number of examples from the psycho-motor domain which can be used to illustrate how a subskill approach can be used to facilitate goal attainment. To support the notion that one learns to read by reading meaningful material, Smith (1973, p. 195) mentioned that one learnsto ride a bicycle by getting practice riding the bike. However, it should be pointed out that children often go through a graded series of experiences of increasing difficulty before they learn to ride a large-frame, two-wheel bike. They frequently practice first on a tricycle, then graduate to a two-wheeler with a small frame, and practice getting their balance on the small-frame bike before they use the pedals on the two-wheeler.

One might inquire into the most desirable method to use in teaching a child to ride a bicycle. Would it be preferable simply to place the child on a two-wheeler or to allow the child to gather experience on a graded series of activities, each somewhat more difficult, before encountering the two-wheel bicycle?

Today, the methodology of teaching down-hill skiing has advanced to the point where advanced skills can be taught in significantly less time than was previously required. First, a subskill approach is used. More complex skills are built upon less difficult skills. But perhaps the most significant recent advance has been with the GLM, graduated length method. The beginning skier uses short skis to practice his basic moves and then advances to longer skis as skill develops.

The sport of wrestling is similar in many ways to the game of chess. For every move there is a countermove, and countermoves to countermoves. However, unlike chess, in wrestling the athlete has little time to think, and the one who is fastest and most automatic in his moves has the advantage. Every move in wrestling is broken down into its parts and the athlete practices these parts prior to putting them together to form a move which has fluid motion. When a move is finally mastered, combinations of moves are worked together to form larger units or patterns of moves.

Much the same can be said about learning dance steps. In watching skilled dancers, we are observing combinations and variations of steps which are strung together. The trick in learning a new dance step without the aid of a teacher is to try to identify the basic move from which the variations originate. What the teacher does to simplify learning a dance is to select the basic step and to teach the subskills which comprise the basic step. Years ago the Arthur Murray system used this procedure to introduce people to social dancing. Their basic step was called the box step and was

used to introduce a number of dances as well as their variations.

Leaving the psychomotor domain, one can find examples from perception and reading to illustrate the principle that smaller units are mastered prior to mastering the larger units. The model of perceptual learning developed by LaBerge and Samuels (1974) is a hierarchical model and shows the sequence and progression of learning from distinctive features, to letters, to letter clusters,and on to words. In the process of learning to recognize a letter, the student must first identify the features which comprise the letter. For the lower-case letters "b", "d", "p", and "q", the features are are vertical line and a circle in a particular relationship to each other; that is, the circle may be high or low and to the left or right side of the vertical line. Having identified the parts and after an extended series of exposure to the letters, the learner sees it as a unit. In other words, the parts are perceptually unitized. There is evidence recently gathered at our laboratory that skilled readers appear to have perceptually unitized--or chunked--digraphs such as "th", "ch", and "sh". These are not processed as "t" + "h", "c" + "h", or "s" + "h", but as a single unit. Other evidence gathered elsewhere(Gibson & Guinet, 1971)indicates that units longer than the letter, such as affixes "-ed", "-ing", can become perceptually unitized. These findings from different laboratories suggest that perceptual learning seems to follow a pattern from smaller to larger units.

At one time, following the suggestions found in Gestalt psychology, there was a belief that when a beginning reader encountered a word, the perceptual unit was the whole word. Research by Marchbanks and Levin (1965) and Samuels and Jeffrey (1966) indicated that children tended to use a single letter rather than the whole word as the cue for word recognition. In fact, it is not until the 10th grade that it appears that a single eye fixation suffices to take in the whole word at once (Taylor, et al., 1960).

Still other examples are available to illustrate the point that subskill mastery is necessary prior to achieving skill in reading. The purpose of a recent study by Shankweiler and Liberman (1972) was to investigate whether the main source of difficulty in beginning reading is at the word level or at the level of reading connected text. In other words, how well could one predict a child's fluency in oral reading of paragraph material from his performance on selected words presented in tests? The average correlation was .70 between reading individual words on a list and reading connected discourse. Thus roughly 50% of the variability in oral reading of connected words is associated with how well one can read these words in isolation. The authors concluded, "These correlations suggest that the child may encounter his major difficulty at the level of the word--his reading of connected text tends to be only as good or poor as his reading of individual words." (p. 293)

A similar conclusion was reached by a classroom teacher with perceptive insights into problems children have with reading. She wrote:

> "...there has been great emphasis put on developing the child's comprehension ability. It is true that poor readers in the upper grades wrestle with comprehension problems. I have found this problem stems mainly from the student's lack of word-decoding skill. The comprehension cannot improve until the reading process becomes automatic, a development that takes place after the conscious analysis skills have been mastered. Therefore, though you want the child to understand the story he is learning to read, his ability will not be perfected until the child actually learns to read accurately. (Stevenson, 1974, p. 20)

Before leaving this section, two laboratory studies should be described which investigated a problem of some importance to reading. This problem dealt with the question of what type of initial training in reading--phonics versus the whole-word approach-- provides the best basis for transfer to reading new words. One of the studies was done with children who were non-readers (Jeffrey & Samuels, 1967) and the other used adults who had to read using an artificial alphabet (Bishop, 1964). Both studies came to the same conclusion, that specific training on letter-sound correspondences was superior to whole-word training for transfer to recognizing new words.

This section on the role of subskills in learning has looked at complex cognitive skills such as learning telegraphy and transfer tasks in reading, "simple" cognitive tasks such as associational learning of letter-names, perceptual learning and psychomotor learning. What psychologists have learned from these tasks is that they are comprised of lower-order skills, mastery of the higher-order skill may be contingent on mastery of lower-order skills, and that successful attainment of the final task may be facilitated by helping the student to master the lower-order units.

Validating Learning Hierarchies

White and Gagne (1974, p. 19) have written that "...the validity of hierarchies should now be considered virtually at an end because of the increased support for hierarchies provided by the evidence of recent studies." Athey's (Note 3) National Institutes of Education position statement for essential reading skills states:

> Every system of teaching reading presupposes some kind of hierarchy, explicitly or implicitly, as a condition of proceeding toward some goal in a rational manner. One possible reason for this is that the concept of a hierarchy

has an inherent appeal in that it appears to present a logical and rational method to approach the instructional process.

Historically, the curricula that teachers have used regardless of the method employed, have been organized on the basis of some preconceived hierarchy. This procedure has received some theoretical support in the concept of developmental stages and the associated concept of readiness.

On the other hand, hierarchical systems appear to have some basis in the behavioristic approach as exemplified in programmed instruction, in which a terminal task is analyzed into small steps of progressive difficulty and the student is moved through the individual steps at his own pace. The underlying assumption is that learning will progress maximally if the task is broken down into small steps through which the child progresses in an orderly sequence at his own pace.

Learning hierarchies have been described as patterns of learning tasks that lead to a terminal skill: each subordinate task can be considered a prerequisite for the task above it, the subordinate prerequisite skills providing transfer to the terminal behavior (White & Gagne, 1974). Gagne (1974, p. 12) wrote:

> The tasks that people are expected to do must be analyzed into trainable components. First, each task must be broken down into behavior capabilities that are not themselves the task, but are <u>contributors</u> to the performance of the task.

Second, these contributors must be further classified, if possible, into types that serve to identify different optimal conditions for their learning (and thus for the instruction that supports learning). Without such analysis and categorization, all one can say about optimal instruction is to apply general rules such as "motivate the learner," "use the principle of contiguity," and "arrange the contingencies of reinforcement." The unquestioned validity of these principles is not enough. With task analysis, one can begin to deal directly with the planning of instruction for differenc kinds of learning outcomes.

Task analysis, then, was conceived as a technique which could be brought to bear upon the problem of how to get from known human tasks to designed optimal conditions of instruction which would yield competence in those tasks. Of course, there are some tasks for normal human adults which need no instruction--such as "closes the door," or "makes a check mark," or "counts the number of people in a room." There are still others which require a minimum of instruction, and which therefore need no instructional design, such as "to energize the starter, turn key to right," or "to turn on the lights, push the switch upwards." But in many other instances, people cannot perform the tasks competently without a measurable period of learning, often accompanied by instruction. Task analysis was proposed as a method of identifying and classifying the behavioral contributors to task competence, for which differential instructional design was possible and desirable.

Despite claims by White, Gagne, and Athey that learning hierarchies do exist, there are contrary claims. To determine the subskills in reading comprehension, factor analysis has been used to study this problem. Davis' analysis (1944) identified 9 subskills, of which 6 were significant. However, a refactorization of Davis' data by Thurstone (1946) suggested that except for word knowledge, the reading skills were not separately distinguishable The most recent refactorization of the Davis data by Spearritt (1973), using a different technique, has in fact revealed that word knowledge and three other skills were shown to be separately identifiable, but the latter three skills were highly correlated and could be measuring a single skill.

Perhaps the major methodological weakness of those factor analytic studies attempting to identify subskills in reading, aside from the fact that the tests which have been used were not designed to reveal subskills, is the failure to differentiate between good and poor readers in the analysis. The fluent reader has mastered the subskills, combined them into higher units so that the inter-correlations among subskills should be high, thus making reading seem to be but one skill--called reading. On the other hand, the beginning reader has not mastered the subskills, has not combined these skills into higher units, and so the intercorrelations among the subskills should be low. Guthrie (1973) designed special tests and analyzed the intercorrelations separately for the good and poor readers. As predicted, he found with the good readers the intercorrelations were highly significant, suggesting lack of subskills and that reading had become but one skill. With poor readers, the opposite was found and the low intercorrelation suggested separate subskills. Guthrie concluded that interfacilitation among subskills was necessary for good reading and that one source of disability among poor readers was the lack of mastery of subskills with subsequent interfacilitation of subskills into higher-order units.

Based on substrata factor theory and analysis, Singer (Note 4) has argued that a hierarchical structure of tasks does exist in reading. Guthrie (1973) used analysis of variance and Guttman sealing analysis and found learning hierarchies in reading comprehension, which differed for good and poor readers. In completing this section, it should be brought to the reader's attention that a number of summary articles on learning hierarchies are currently available (White, 1973; White and Gagne, 1974; Gagne, 1973).

Learning Hierarchies in Reading

Despite the fact that learning hierarchies have a logical appeal, that we have known about them for at least 3/4 of a century, and that commercial reading series, with their scope and sequence charts, order the reading tasks as if we did know the nature of the learning hierarchy in reading, the sad truth is that the task is so complex that a validated reading hierarchy does not exist. Athey (Note 3) has said, "The mere construction of hierarchies through logical means has not always proven to lead to a valid hierarchy. Until valid hierarchies have been established and proven to be efficient means of indicating instructional sequencing, the use of hierarchies to determine instruction remains based on an unproven assumption."

Part of the reason for the state of ferment and confusion about reading hierarchies is thateducators have approached this problem as if there were one hierarchy and one way to sequence these subskills. Important distinctions between subskill sequence, teaching-learning sequence, and performance sequence have not been made. To illustrate how these distinctions can be useful, assume an objective upon which a task analysis will be performed. The objective (terminal behavior) is, "When shown a new word, the student will be able to pronounce it." Three subskills are essential for successful completion of this objective: a) a left-to-right visual scan;

b) letter-sound knowledge; and c) ability to blend the sounds to form the word (see Figure 1).

Insert Figure 1 about here

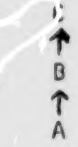
One decision which must be made is in which order the subskills should be introduced. Actually, it makes no difference to the final outcome in which order they are introduced. Another decision which must be made is what the most efficient teaching-learning sequence might be in introducing a particualr subskill. Recent research indicates that a particualr sequence is most desirable. For example, in learning letter-sound correspondences, the perceptual learning phase should be separated from and precede the response hook-up phase. Furthermore, in order to help the student learn the distinctive features of each letter, the visual discrimination training should be on high-similiarity letters (ex: b, d, p, q). Simultaneous discrimination training should be given prior to successive training since it is during the simultaneous phase that the features are most easily noted while during the successive discrimination phase these features can get chunked in memory. Following perceptual training, the response hook-up phase can be introduced. Each training phase should go beyond accuracy to automaticity (Samuels, 1973; LaBerge & Samuels, 1974). Once the three subskills have been mastered, the student is ready to attempt the objective.

In performingthe terminal behavior, it is imperative that the subskills be performed in the order of A, B, and C. First; the reader must scan the letters from left to right. Second, the letters must be sounded. Third, the letter-sounds must be blended to form the word. This particular example illustrates that for certain objectives it may make no difference in which order the subskills are introduced, that there is a preferred teaching-learning sequence for a particular subskill, and that in order to perform

the terminal behavior, a particular sequence may be essential.

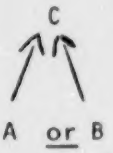
As mentioned earlier, different kinds of hierarchies may exist in reading depending upon the terminal behavior to be taught. The different types of hierarchies are outlined below (Athey, Note 3):

1. Contingency Relationship. Successive skills each of which is necessary to the mastery of the next step (e.g. A is necessary to B , B to C, etc.).



1a. Conjunctive Contingent Relationship. Successive skills in which more than one skill is necessary to the mastery of the next step (e.g. A and B necessary to C).

1b. Disjunctive Contingent Relationship. Successive skills in which there is a necessary relationship of skills, but alternate routes may lead to the goal.



2. Supportive Relationship. No skill is necessary to the next step but the skill may facilitate acquisition in the sense of providing positive transfer (e.g. learning sets, learning-to-learn, acquisition of algorithmic approaches to a problem).

Different approaches are available for the purpose of determining hierarchies. To mention sevral of the methods which have been used Gagné (1962) took a terminal behavior, fractionated it into subskills which were ranked from lower to higher order, and developed tests for each level. He found that students who failed a lower-order task were unable to pass a test at a higher level. Guthrie and Seifert (Note 5) have used analysis of variance and Guttman scaling, while Airasian and Bart (1974) have used tree theory to determine hierarchies.

Implications for Reading Instruction

A major point made by critics of the subskill approach is that fractionating the reading process interferes with the essential characteristic of reading, which is comprehension. This point is well taken. Many teachers who use the subskill approach have lost sight of the fact that the subskill approach is simply a means to an end. What has happened in many classrooms is that goal displacement has occurred and the means have become ends in themselves. In using the subskill approach, care must be taken to prevent the subskills from becoming the focal point of instruction. Once again, perhaps, this point should be made, that it is important for the child to get ample practice reading meaningful and interesting material in context.

While agreeing with the critics of the subskill approach that too much emphasis can be placed on these subordinate skills, the critics probably are in error in failing to recognize the importance of subskills in the developmental sequence of skill attainment. Just because fluent readers are able to access the meaning in a printed page is no reason to believe that beginning readers can do the same or that we can transfer the sophisticated strategies of the fluent reader to the beginning reader. While it is true that sophisticated strategies can be taught to the less sophisticated, these transfers of skills have been accomplished by doing a task analysis of the sophisticated strategies and teaching these subskills to the beginner.

As the advocates of the holistic approach point out, the essential element of reading--deriving meaning--is destroyed by taking a whole and breaking it down. However, current research suggests that before one deals with wholes, smaller aspects have to be mastered first. For example, before one can visually process letter clusters as a unit, individual letters

have to be unitized. The controversy between letter-by-letter and whole word processing in word recognitionseems somewhat resolved now that we have evidence to indicate that familiar words can be processed by fluent readers as a unit while unfamiliar words tend to get processed letter-by-letter.

Many critics of the subskill approach suggest that meaningful reading material should be given to a child and subskills should be taught when the student asks for help or shows evidence of needing particular skills. This approach has shortcomings when one realizes the logistical and managerial problems facing the teacher with a large group.

With regard to this last point, it is important to consider that many students do not know what kind of help to request and many teachers are not sufficiently trained to diagnose and pin-point the cause of the student's difficulty. Even when the teacher is able to diagnose the cause of the problem with accuracy, the managerial problems of giving individual help as needed loom so large as to make the system difficult to operate, if not unworkable. It would seem more manageable to assume on a priori grounds that there are certain subskills beginning readers require. These skills would be taught routinely to students. For those students who fail to master these skills, additional time could be allocated and different methods could be tried.

Earlier in this paper the point was made that the adverse relationship between holistic and subskill approaches may not exist. Both approaches recognize there are subskills. Subskill approaches start with smaller units and move to larger and more complex units. On the other hand, the holistic approach begins with the larger unit and moves to smaller units. One of the important factors differentiating the two approaches is that of sequencing. In considering this factor, we must think about

which tasks and which unit size one would use to start instruction and how one would program the sequence of skills to be taught as the student progresses in skill.

Another similarity between the two approaches is that both recognize the importance of diagnosis of difficulty in reading and the need to remedy theproblem. The subskill approach, however, attempts to reduce the number of students who will experience difficulty with reading by teaching the prerequisite skills before a problem appears. The subskill approach, therefore, would appear to be more efficient in terms of teacher time.

Although at the present time we do not have validated learning hierarchies in reading, we do have a fairly good idea of what the necessary subskills may be. From time to time researchers uncover new skills which are important prerequisites to reading. For example, a substantial body of research now exists which indicates that children have difficulty with metalinguistic aspects of instruction. Teachers use many terms in instruction which are unfamiliar to many students. Technical terms such as "letter," "word," "sentence," and ordinal positions ("first," "second," "third," etc.) may have no meaning to some children. Before these children can profit from instruction, they need help in understanding the language of instruction. At the present time we need to continue our work on validating a minimal set of subskills in reading and on determining their optimal sequence.

Reference Notes

1. Venezky, Richard L. Language and cognition in reading. Technical Report No. 199, Wisconsin University, Madison, Office of Education (DHEW), Washington, D.C., 1972.

2. Goodman, K. S. The reading process: Theory and practice. Paper presented at the annual meeting of the International Reading Association, Anaheim, California, May, 1970.

3. Athey, I. Essential skills and skills hierarchies in reading comprehension and decoding instruction. Paper presented at conference of the National Institutes of Education, 1974

4. Singer, H. Theories, models, and strategies for learning to read. Paper presented at the National Reading Conference, St. Petersburg, Florida, December, 1970.

5. Guthrie, J. T., & Seifert, M. Learning hierarchies in reading comprehension. Unpublished manuscript, Johns Hopkins University, Baltimore, Maryland, 1974.

References

Airasian, P., & Bart, W. Ordering theory: A new and useful measurement model. Educational Technology, 1973, 13, 56-60.

Bishop, C. H. Transfer effects of word and letter training in reading. Journal of Verbal Learning and Verbal Behavior, 1964, 3, 215-221.

Bryan, W. L., & Harter, N. Studies in the physiology and psychology of the telegraphic language. Psychological Review, 1897, 4, 27-53.

Bryan, W. L., & Harter, N. Studies on the telegraphic language. The acquisitic of a hierarchy of habits. Psychological Review, 1899, 6, 345-375.

Bumstead, J. Cited in Nila B. Smith, American Reading Instruction. New York: Silver, Burdett and Company, 1934.

Davis, F. B. Fundamental factors of comprehension in reading. Psychometrika, 1944, 9, 185-197.

Flesch, R. Why Johnny can't read. New York: Harper Brothers, 1955.

Gagne, R. M. The acquisition of knowledge. Psychological Review, 1962, 69, 355-365.

Gagne, R. M. Task analysis--its relation to content analysis. Educational Psychologist, 1974, 11, 11-18.

Gedike, F. Aristoteles und Basedow oder Fragmente Über Erziehung und Schulwesen bei den Alten und Neuren. Berlin und Leipzig, 1779.

Gibson, E. J., & Guinet, L. Perception of inflections in brief visual presentations of words. Journal of Verbal Learning and Verbal Behavior. 1971, 10, 182-189.

Goodman, K. S. Orthography in a theory of reading instruction. Elementary English, 1972, (December), 1254-1261.

Goodman, K. S. Reading: The key is in the children's language. The Reading Teacher, 1972, (March), 505-508.

Goodman, K. S. Strategies for increasing comprehension in reading. Scott, Foresman Monograph. Palo Alto, Ca: Scott, Foresman and Company.

Guthrie, J. T. Models of reading and reading disability. Journal of Educational Psychology, 1973, 65, 9-18.

Hilgard, E. R., & Marquis, D. G. Conditioning and learning. New York: Appleton-Century-Crofts, Inc., 1961.

Jeffrey, W., & Samuels, S. J. Effect of method of reading training on initial learning and transfer, Journal of Verbal Learning and Verbal Behavior, 1967, 6, 354-358.

LaBerge, D., & Samuels, S. J. Toward a theory of automatic information processi in reading. Cognitive Psychology, 1974, 6, 293-323.

Lenneberg, F. Biological foundations of language. New York: Wiley and Sons, 1967.

Marchbanks, G., & Levin, H. Cues by which children recognize words. Journal of Educational Psychology, 1965, 56, 57-61.

Mathews, M. M. Teaching to read, historically considered. Chicago: University of Chicago Press, 1966.

Samuels, S. J. Effect of distinctive feature training on paired-associate learning. Journal of Educational Psychology, 1973, 64, 164-170.

Samuels, S. J., & Jeffrey, W. F. Initial discriminability of words and its effect on transfer in learning to read. Journal of Educational Psychology, 1966, 57, 337-340.

Shankweiler, D., & Liberman, I. Misreading: A search for causes. In J. F. Kavanagh & I. G. Mattingly (Eds.) Language by ear and by eye: The relationships between speech and reading. Cambridge: The MIT Press, 1972.

Singer, H., Samuels, S. J., & Spiroff, J. Effect ofpictures and contextual conditions on learning to read. Reading Research Quarterly, 1974, 9, 555-56

Smith, F. Psycholinguistics and reading. New York: Holt, Rinehart and Winston, Inc., 1973.

Spearritt, D. Identification of subskills of reading comprehension by maximum likelihood factor analysis. Reading Research Quarterly, 1972, 8, 92-111.

Staats, A. W., & Staats, C. K. Complex human behavior. New York: Holt Rinehart and Winston, Inc., 1963.

Stevenson, N. The natural way to reading: A how-to method for parents of slow learners, dyslexic and learning disabled children. Boston: Little, Brown & Co., 1974.

Taylor, S. E., Frackenpohl, H., & Pettee, J. L. Grade level norms for the components of the fundamental reading skill. Huntington, N.Y.: Educationa Developmental Laboratories, Inc., 1960.

Thurstone, L. L. Note on a reanalysis of Davis' reading tests. Psychometrika, 1946, 11, 185-188.

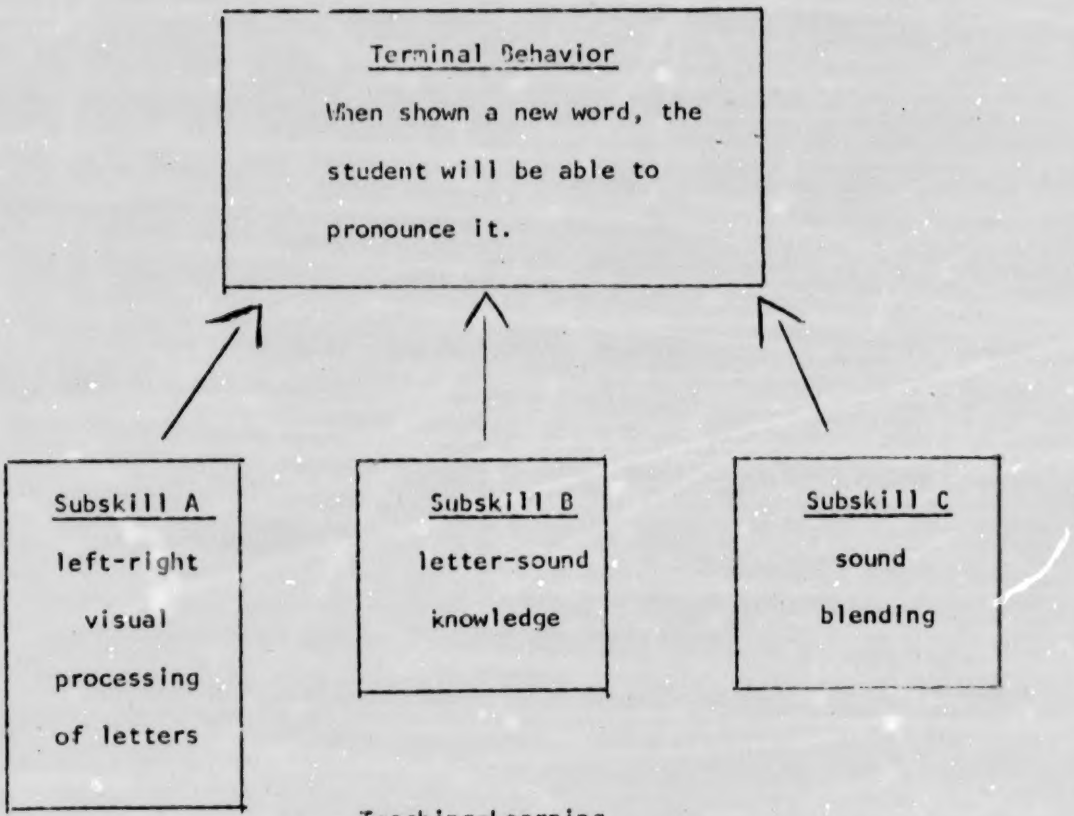
White, R. T. Research into learning hierarchies. Review of Educational Research, 1973, 43, 361-375.

White, R. T., & Gagne, R. M. Past and future research on learning hierarchies. Educational Psychologist, 1974, 11, 19-28.

Footnote

Invited Address, Hyman Blumberge Symposium on Research in Early Childhood Education, November 14, 1974. Support for this paper was provided by the Minnesota Reading Research Project (National Institutes of Child Health and Human Development Grant #HD-06730-01), by the Center for Research in Human Learning (National Science Foundation Grant #GB-17590), and by the Research, Development, and Demonstration Center for the Handicapped (Bureau of Education for the Handicapped).

Figure 1



Teaching-Learning Sequence

1. Perceptual Training
   a. Simultaneous discrimination
   b. Successive discrimination
2. Stimulus-Response Hook-up

Subskill Sequence: Subskills can be introduced in any order.

Performance Sequence: In performing the terminal behavior, the subskills must be done in fixed sequence A, B, C.

Figure one. Subskills which must be mastered in order to achieve the terminal behavior.